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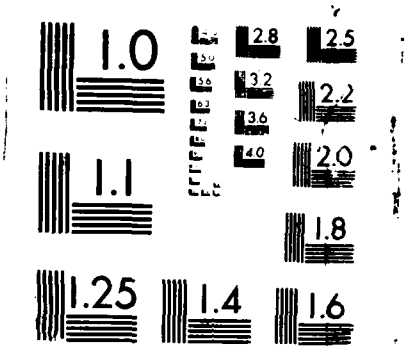

AIR WAR COLLEGE

RESEARCH REPORT

No. AU-AWC-87-230

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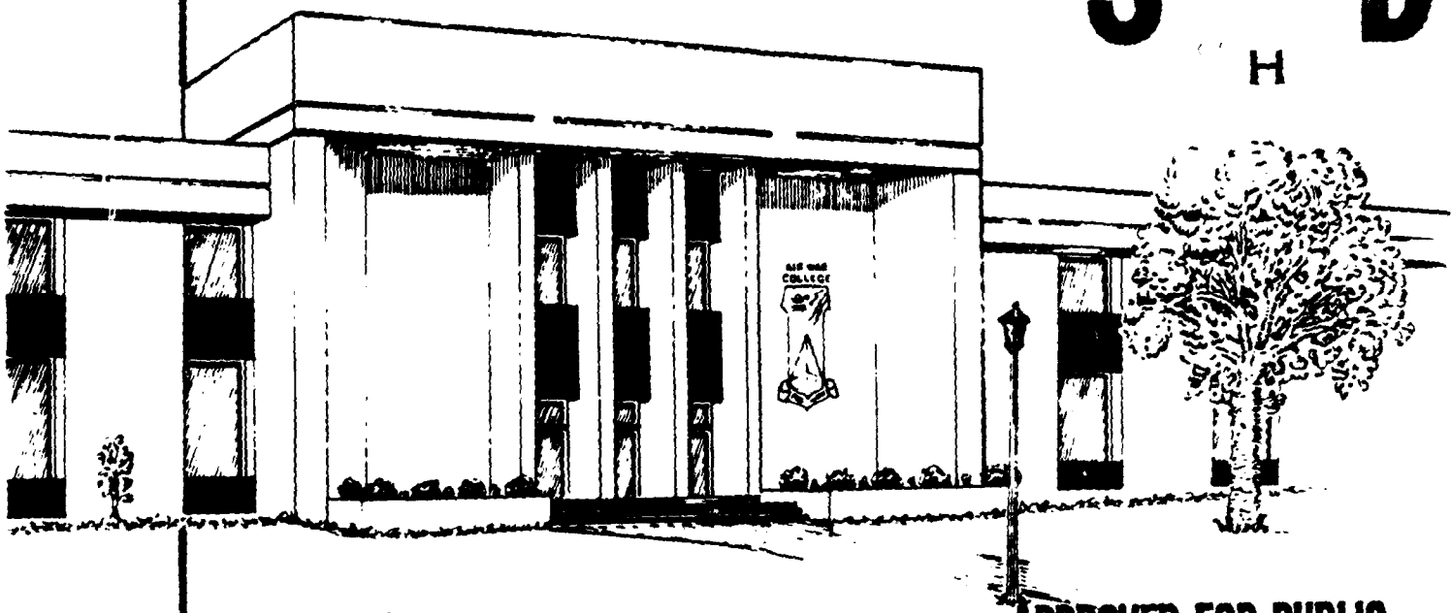
By LIEUTENANT COLONEL RICHARD WOLSZTYNSKI, FRENCH AIR FORCE



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A COMMANDER'S VIEW:
WHY IS ONE WEAPON SYSTEM BETTER THAN ANOTHER?

by

Richard Wolsztynski

Lieutenant Colonel

A RESEARCH REPORT SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE RESEARCH

REQUIREMENT

ADVISOR: COLONEL JIMMY POOLE

AIR WAR COLLEGE RESEARCH REPORT ABSTRACT

TITLE: A COMMANDER'S VIEW: WHY IS ONE WEAPON SYSTEM BETTER THAN ANOTHER?

AUTHOR: Richard Wolsztynski, Lieutenant Colonel, French Air Force

The objective of this report is to try to point out that the mission must change to meet the threat--a threat which is no longer just one aircraft but a weapon system. To be effective, a pilot must take an exhaustive view of such a system, and in this way counter the threat. He will be able:

- To better understand the possibilities and the limits of the system
- To realize that he is both a part and the head of the system
- To comprehend how the different components of the system are interrelated
- To find when and how to emphasize realistic and safe training
- To counter the threat that he now knows as well as the weapon system he belongs to because they are both made the same way.

LIEUTENANT COLONEL RICHARD WOLSZTYNSKI

Richard is a graduate from the Ecole De L'Air and participated in Fall 1969 in the first student exchange program between the French Air Force and the USAF Academy. After his fighter pilot training, he was assigned to a Mirage 3E air defense squadron in COLMAR where he was selected as a flight commander in 1977. From 1977 to 1980, he was the squadron commander of a recce squadron in STRASBOURG. After one year in the French Air Force Inspection Team, he joined the 2nd TFW in DIJON in 1983 where the wing was just about to start its conversion on the MIRAGE 2000. He was the officer commanding the wing until 1986 when he arrived at Maxwell AFB to attend the AWC Class of 87.

TABLE OF CONTENTS

CHAPTER		PAGE
	ABSTRACT	ii
I	INTRODUCTION	1
II	A WEAPON SYSTEM: SCHEME AND DEFINITION . .	3
III	THE OBJECTIVE	5
IV	PERFORMANCE	7
V	TACTICS	10
VI	THE PILOT (OR CREW)	13
VII	ORDNANCE DELIVERY	16
VIII	TRAINING	18
IX	CONCLUSION	22

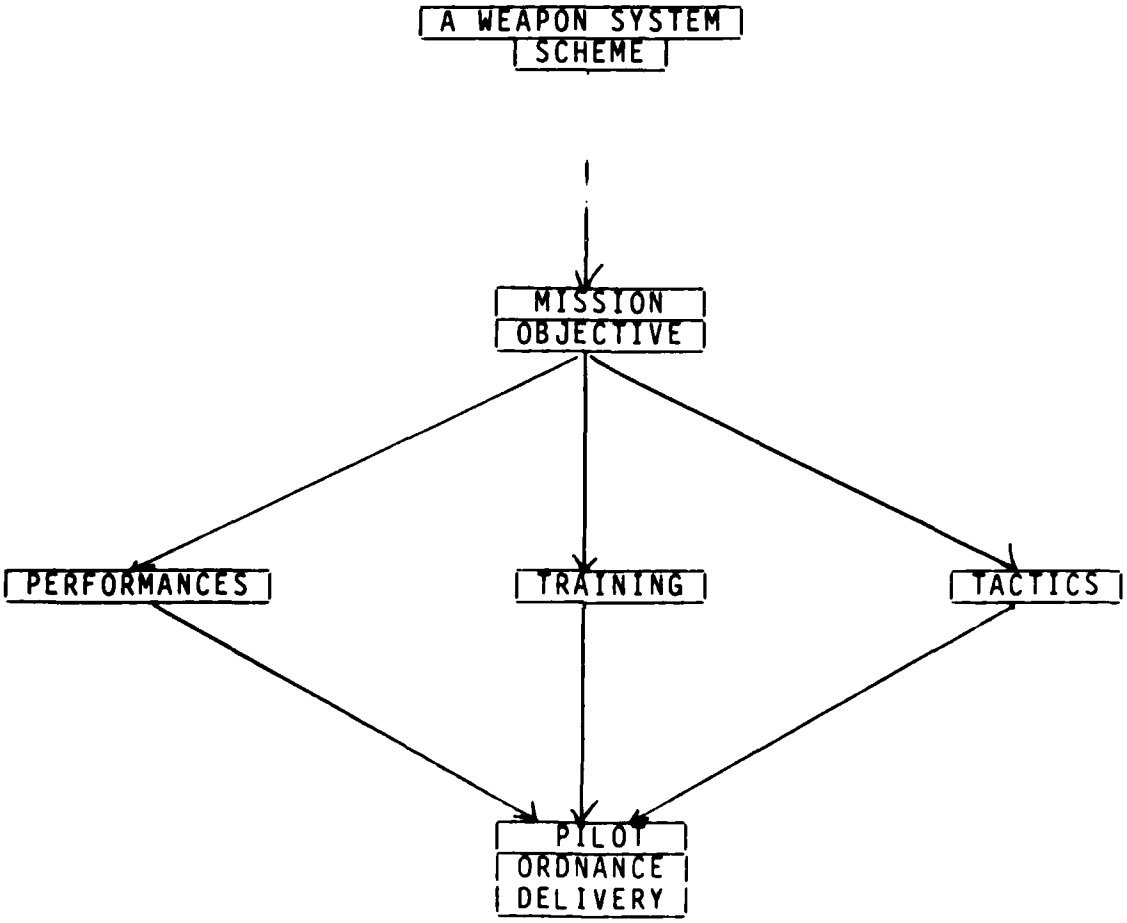
CHAPTER I

INTRODUCTION

Is the F-15 better than the F-4? This question should be answered, "yes, of course"! But when I ask the question, what am I talking about?, What am I comparing?, The aircraft, the pilot's skills, the radar possibilities . . . or all of that together? And what about an F-15 with a poor radar due to technical problems against an F-4 with everything running perfectly and a pilot flying his best mission? You may say that if there are problems, an aircraft should be grounded, but I am talking about problems which occur once you're airborne with your enemy airborne too. In this case, your objective is still in front of you and you must either meet the threat or disengage.

I think that it is important to realize at this point that the pilot with his background and experience is flying a weapon system that he is a part of and the head of. The better he understands his weapon system and that of the enemy, the more effective he will be in fighting the enemy.

So let's take a look at a weapon system. What are the different components and how are they interrelated?


A WEAPON SYSTEM
SCHEME
MISSION
OBJECTIVE
PERFORMANCES
TRAINING
TACTICS
PILOT
ORDNANCE
DELIVERY

CHAPTER II

A WEAPON SYSTEM: DEFINITION

When we talk about the strength of a country, we examine its military forces and its industrial capacity, but we must also take into account the will of the people, the political structure which may or may not reflect this will . . . I shall use this same approach to define a weapon system. I think that we must go far beyond the pure technical aspects of the definition which sometimes leads one to think that the pilot's role is reduced. Even in this technical aspect, the system is also much more than the air-to-air missile associated with a high performance radar. So what is it?

To me a weapon system is made of aircraft performance and tactics which through a trained pilot has only one goal: to accomplish the mission of delivering ordnance on an objective in the most effective way possible.

Aircraft performance factors represent the technical aspect. They have to be discovered, checked, and understood in order to maximize the entire system. Tactics reflect the skill of analysis, judgment and ability and are also the heritage of an air force--the lessons of previous uses of air power. Once the tactics are taught and refined, the problem

is only half solved because the pilot will now have to apply these tactics in a real operational environment.

The pilot, the human factor, must be selected, trained, and prepared using the experience and imagination of older aviators and tacticians. As technology and computer science continue to improve the capabilities of present systems, it is necessary to have adequate training means to allow a pilot to be familiar with all these possibilities, especially when it becomes more and more a matter of almost instant response. One major difficulty in training is that it must be both realistic for operational purposes and safe for peacetime use. The first requirement implies high risk while the latter tends to decrease the risk as low as possible. This is a major problem an Air Force is faced with when dealing with training.

Training must not be or become one way communication; it must be an exchange between an instructor and a student for the benefit of both of them, as it is in combat, where leader and wingman need each other to accomplish a mission.

In other words, a weapon system goes into action when the mission is assigned to a trained pilot who will have to accomplish an objective by the use of performance and tactics.

CHAPTER III

THE OBJECTIVE

The assignment of an objective is what initiates the mission process. It generally comes from an overall strategy provided by a higher headquarters. The question then becomes: "How are we going to do it?"

To answer this question, it is important to start from the objective and not go through the chronology of the mission first. The main reason for this is if time for preparation happens to be short, and I would suggest that this should be the permanent assumption, it is vital to know the objective as well as its' close environment. The way to use a weapon system may be *understood*, but the unknown is the objective; all available time must be spent on this point. All the rest, even if it is difficult--for example, because the mission profile requires air refueling in very bad weather conditions--must be considered as known tools to get the objective. In other terms, performance must permit pursuit of an objective, but we must take into account the fact that the enemy does not want this objective to be achieved and offensive or defensive tactics will have to be used.

Another important relationship I want to point out is the one between the objective and the ordnance. In a conventional air-to-ground mission it is important to have a

secondary objective; it must be easy to find and to see, because there will be no special pattern flown to reach it. This secondary objective will be hit by the ordnance planned for the primary objective when it can not be reached for some reason. It is usually not safe for a fighter-bomber to return and land with its external air-to-ground ordnance.

In an air-to-air mission the problem is different because the fighter may be still involved in combat while running out of ammunition which may put him in a dangerous posture offensively. Performance and tactics must enable him to disengage as he can no longer achieve his objective due to shortage or malfunction.

CHAPTER IV

PERFORMANCE

Performance factors are the first tools to achieve the mission. How effectively this will be done depends directly both on the system capabilities and on the way they are known and used by the pilot.

Performance factors and system characteristics are known quantities. They include fly by wire controls, modular turbofan high performance engines, integrated navigation and armament systems. The problem here is how they are related to the pilot.

The tendency may be to view the weapon system performance as the element which makes the main difference in combat, and may lead one to think that if one has superiority because of performance, on a pure technical standpoint, that their weapon system is superior to those from the other side. This is what I call the "fascinating aspect" of performance and is something that pilots must be cautious of. The problem a pilot is faced with when dealing with system performance factors is knowledge and utilization of the system capabilities.

With the older systems, system operation required substantial pilot involvement because of imperfections and low reliability. Today, a pilot expresses a demand to the control

system or to the engine and he usually and immediately gets an optimum response. He does not have to worry about the limits in most cases because the system limits itself. This brings about efficiency and comfort.

Efficiency is great, but comfort may be dangerous for the pilot because it may obscure signs which indicate that he is approaching system limits, including his personal physical limits. This is particularly true with fly by wire controls which may push a pilot to limits beyond optimum use. Even with fly by wire controls, managing the total system energy remains a key rule. Also knowledge and utilization of weapon system performance can be totally dissociated. Most subsystems are designed to make their utilization as simple and easy as possible.

The price for this is a system that is increasingly sophisticated and complex with limited on line maintenance. Malfunctions generally result in a check or exchange of equipments or computer cards without any possibility of repair. This may adversely affect the use of the system in a very restrictive environment (war time).

Although it is not necessary for a pilot to be an expert in explaining how the system performance factors are obtained and work on the system he is flying, he must know and understand it well enough to be able to do two things:

- know exactly if he can continue toward the mission objective in case of partial failure.
- know how to recognize the limits of system use in action.

This leads me to relate performance and training. It is easy to find system limits in the book, but it is much more difficult to recognize them in action. This should be a major goal in training because it is key in combat and key to cohesion within a flight. Training must focus on understanding system performance factors, their limits, and the key points of these limits.

Here, I would like to relate performance factors to tactics because if performance characteristics have been improved, it is essentially to increase the chances to win or succeed in a mission. This means, when flying a mission, that system capability should allow the pilot to maximize avoidance of any threat which is not his objective, and be able to achieve the mission even after a major change in the planned profile. High performance generates and supports good tactics.

CHAPTER V

TACTICS

As we are moving forward in the analysis of a weapon system, we are now at the point where we can see a very important relation between performance and tactics in achieving a mission.

Employing a weapon system without smart tactics will generally lead either to a head on confrontation with the enemy's systems resulting in unnecessary attrition or to a dangerous situation if the enemy attacks with his weapon system of equal performance and employs better tactics.

Tactics used in an offensive way will help to penetrate an enemy's shield by avoiding it, saturating or confusing it, and sometimes destroying it enroute to the objective. Tactics in this case will be a matter of coordination between strikes, between weaponry and electronic warfare, and also between the understanding and optimum use of your weapon system. For example, if your radar can lock on a target outside of missile firing range, you should not lock on and let your enemy know what you are doing. This means that performance and tactics are complementary and that the common goals of discretion (radar, radio) and autonomy (navigation, interception) reduce the vulnerability of the system you are flying.

On the other hand, tactics used in a defensive way may provide tools which will permit a pilot to find an enemy coming in behind a shield made of electronic countermeasures. To avoid surprise, which means space and time chosen by the enemy, tactics must help to set up an efficient deployment of the alert assets as well as an effective coordination between detection and firing means.

We can say here that, if performance characteristics are the state of the art, then tactics are the state of the reflection, of thinking about how to use these performance characteristics in an efficient and optimum way.

Training must take into account this very close and complementary relationship between performance and tactics. High performance enables good tactics, as we mentioned before, by increasing discretion and autonomy, but in case of failure, malfunction, or inferiority of performance, a knowledge of tactics must exist to enable a pilot to be ready to take over and complete the task. This point is particularly vital in a defensive posture when trying to disengage. Training must emphasize this aspect and warn the pilot to be aware of the limits of system performance and enable him to compensate using tactics he has learned in previous ground and airborne research.

The role of the **pilot** is very important because he is at the choke point of both performance and tactics.

Overall system performance enables him to solve most of the problems he may have in flying the aircraft, getting the armament system ready, and in visualizing the environment (HUD). In other words, system performance may reduce the workload of the pilot, so he can focus on the tactics necessary to accomplish the mission. This means also that he must know the enemy's systems characteristics and be able to use tactics to avoid a direct head on confrontation or if that is impossible, use his own system performance in a way to surprise the enemy.

The pilot is in overall control of the system trying to get the maximum efficiency out of the combination of performance and tactics.

CHAPTER VI

THE PILOT (OR CREW)

As I have mentioned in the previous chapters, the fascination with high technology and improved performance leads some strategists to lean toward replacing the pilot, the only human component of the system. Very recent conflicts have in fact demonstrated that reality (we are talking here of reality which occurs in war) is totally different from fantasy and shows the importance of the pilot when dealing with very sophisticated equipment.

This is a reason why today many designers and engineers no longer try to replace the pilot by super electronic devices but try to aid him in understanding his surrounding environment and in reducing his workload. Pilot workload is reduced by automatic equipment which replaces manual operations. The tools to handle the environment are improved on both intellectual and physical aspects. However, I think that even with some specific physical issues existing with newer sustained high-g performance aircraft, there is no fundamental change in the physical requirements for a pilot and there is no basic change either in the lifestyle and self discipline the pilot must impose on himself. There are basic rules which enhance system performance and rules a pilot applies to employ tactics of a system within the system.

The pilot is indeed a part of and the head of a weapon system. He is the smart component, able to adjust, able to deal with uncertainty, able to give and modify, and when necessary, provides commands to all parts of the system.

The pilot has at his disposal a certain number of tools (head up and head down displays, warning devices, various radios, etc.) to help him analyze a situation, assess what is the best thing to do and make a decision. The role of the pilot is decisive because whatever the quality of the information presented to him is, his judgment, his ability to prioritize the information and his perception of an element which the system will not be aware of because it sees only through angles or sectors, will all enable him to remain in positive control of the situation.

This must be taken into account and kept in mind when selecting and training a pilot. Training must teach a pilot how to manage all the components of a system, train him professionally, and allow him to become an expert. But training must also teach a pilot how to lead in an efficient and realistic way because I believe that the pilot has, and must play the major role in weapon system employment. A pilot must accept responsibility for knowing the job and for understanding what action to take in the course of events. Political leaders and citizens of a nation must have

confidence in a pilot who is a major player in time of tension or crisis.

At this point we can close our loop and come back to the **mission/objective** we have to achieve/destroy a target through an optimum **ordinance delivery**. It is very important for a pilot to realize that he will go first and that he may be the one asked to bring back the evidence of a deployment (recce mission), to identify a violation act (air defense), to strike in a conventional warning mission (ground attack), or to b scrambled on an airborne alert or task with nuclear weapons ready to go as a last step of deterrence. Each of these missions will have to be carried out with the best chance of succeeding for freedom and peace will be a stake.

CHAPTER VII

ORDNANCE DELIVERY

I would like ordnance delivery to have the major emphasis because my purpose is to point out that the technical, tactical, and psychological approach to the ultimate step of the mission is the same whether you are talking about using a missile, gun, a counter measure release, or a camera. In addition, there are other very important aspects of this final step which have to be considered and kept in mind:

- If ordnance delivery is often a matter of seconds, these must be seconds of extremely high concentration, judgment and effectiveness.
- Once the objective is hit, the pilot still has to fly the weapon system back into a friendly environment.
- In some specific missions access to the target is only half of the job, because the results, will have to be transmitted or brought back.
- The pilot must always consider the possibility of a malfunction in ordnance delivery which may surprise him, disturb him, or break the coordination of a combined attack or operation, reducing the chances of success.

- Finally the pilot must never forget that the greatest danger to him is often located in the vicinity of the objective and that his aircraft may be damaged at a moment when he is already under pressure.

In this final act, the pilot will have to do something, generally very simple--pull a trigger for example although the environment in which he will do it may be as hostile as hell.

So prepare your mission as well, as quick, as simple as you can and above all prepare yourself, on the ground and once airborne learn how to warm up your mind as you are approaching the final step. Do it as an athlete warms up his muscles before the "gold medal" jump. Bring your concentration and attention to such a level that:

- you are ready to go immediately further if required
- you can stay at this level without getting exhausted

This is a key point in training. It affects both effectiveness and safety. Unfortunately there is no instrument to measure this optimum level and each pilot must know his own.

CHAPTER VIII

TRAINING

We are now in the final chapter of this essay. We have discussed what a weapon system is, have seen how the different components are interrelated, and how important the pilot's role is with regard to this network. In each previous chapter, the same point has been emphasized: **training** must be used to maximize overall weapon system capability.

There are three major problems in training: effectiveness, realism and safety. These elements are unfortunately incompatible in most phases of training. My purpose here is to show the emphasize that in training everything is a matter of compromise and imagination, a compromise between effectiveness and safety and the imagination to be realistic. Training must remind the pilot of these important factors in a way that he rapidly becomes aware that if there is a general level of compromise set up for him prior to the flight, he will have after all to feel his own level of compromise, fixed by the environment he actually encounters once airborne.

This leads to what I call "dualism" in training and which must be the bottom line in all the different steps and aspects of training. Let me explain this. Each basic maneuver has a pure technical aspect which must be explained,

demonstrated by the instructor pilot and then executed by the student: example--takeoff of an aircraft. I think that it is important to relate this event to the mission as soon as possible. Takeoff is the first step of the mission. It is also the first time the engine is running full power. This means that they may be an abort, that an adjustment will have to be made or a decision made whether to go to an alternate or not. For a young student pilot this will simply mean: can I still fly the scheduled aerobatic mission or do I have to inform OPS that I am going to fly an alternate practice instrument flight? For a flight leader, this will mean: #3 aborted, #4 cannot take off immediately--can the mission be achieved? Do I have to take into account the delay for my air-refueling time slot? Training must gradually emphasize these aspects: the mission is a series of technical events the pilot has to relate one to the other using one simple and major question, does it affect the mission and how?

The second aspect of dualism is that there is individual training and group training. Group training leads to lecture, briefing, discussion, debate, tactical group research where expertise, knowledge, lessons and heritage are exchanged and communicated. This is an opportunity to focus on what makes air power so terrific. The use of airpower is based upon flexibility and surprise. Flexibility is based upon speed in execution and a very large volume of

intervention. Surprise is based upon rapid engagement and multiplicity and variety in trajectories. But flexibility and surprise are also based upon the pilot's mindset dependent on his ability to adjust and react. In practice, this must be guidelines in a two seater, between the instructor and the student, in a simulator between the pilot and the instructor, on a gunnery range between the pilot and the weapon officer.

Individual training on the other hand is awareness of all I said before, self discipline on both intellectual and physical standpoints, which as I mentioned previously does not mean to live like a monk.

To be a good pilot, and I now should say to be the head of an efficient weapon system, training must be conducted with all this in mind. Getting ready to fly a combat mission is an exciting task. It requires a pilot to always seek the best compromise between effectiveness which may imply high risk and safety which implies low risk. It requires a pilot to be realistic yet imaginative. RED FLAG is a good example of realistic training but with limits in the landscape and the weather in Nevada to that of Central Europe.

Everything should be done to make training effective, realistic and safe, but there is and will always be a limit to this. Hence, the final question is no longer: is my training good? It should be: is my weapon system, training being a very important part of it but yet only part of it, better than

my potential adversary? And above all, am I doing all I can to make it the best possible?

Finally, let us not forget that it is also very important to put a frame of enthusiasm around all I mentioned so far. Enthusiasm is as vital as anything else when dealing with training. Because of this, if you follow your leader with enthusiasm, you will lead your flight with the same enthusiasm and win.

CHAPTER IX

CONCLUSION

I started with: why is one weapon system better than another? I ended up with: am I doing all I can to make it the best possible? To switch from the initial question to the final one, I expressed my personal views and feelings about a weapon system and associated training. To sum up, I would say that:

- A weapon system is a whole made of various elements you ought to look at, and do not neglect or over-estimate any of them.
- The pilot is the one element which allows all the others and the whole to be better than the enemy's weapon system.
- The very few seconds in which the mission is actually accomplished may require months of preparation.
- Training has to make this preparation as effective and short as possible through realism, imagination, and enthusiasm.
- The only real problem is that you will only get your answer if and when you meet your enemy.

END

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